

WHAT IS CLAIMED IS:

Claim 1:

- 1 1. A computer-implemented method for automating operations of a computing
2 arrangement coupled to a message processor, comprising:
3 establishing a pattern database including a plurality of pattern definitions and
4 response definitions, each pattern definition being associated with one or more associated
5 response definitions, and one or more of the response definitions including one or more
6 commands and instructions for queuing a command to a command queue having storage
7 available for a plurality of commands;
8 receiving message character strings at the message processor;
9 searching the pattern database for pattern definitions that match the message
10 character strings; and
11 for the pattern definitions that match the messages, adding associated commands to
12 the command queue in processing the response definitions; and
13 dequeuing commands from the command queue and issuing the commands to the
14 computing arrangement.

Claim 2:

- 1 2. The method of claim 1, wherein the pattern database further includes a pattern
2 definition that matches a command prompt message and further comprising dequeuing a
3 command from the command queue and submitting the command to the computing
4 arrangement in processing the response definition associated with the pattern definition that
5 matches a command prompt message.

Claim 3:

- 1 3. The method of claim 1, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, and the plurality of pattern definitions
4 includes a first definition matching a selected first message from the host, the first message
5 associated with a selected high-level operation of the data storage system, the pattern
6 definitions further including a plurality of definitions matching selected messages from the

7 data storage system generated in performing the high-level operation and having associated
8 responses that are commands required for the high-level operation,

Claim 4:

1 4. The method of claim 1, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, further comprising:
4 defining a plurality of command queue data structures in the pattern database, each
5 command queue having a priority level relative to the other command queues and having
6 storage available for a plurality of commands;
7 for one or more pattern definitions that match the messages, selecting the command
8 queues as selected command queues and adding the one or more associated responses to
9 the selected command queues responsive to instructions associated with the pattern
10 definitions; and
11 for a pattern definition that matches a command prompt message from the data
12 storage system, dequeuing responses from the command queues in priority order and
13 submitting the commands to the data storage system.

Claim 5:

1 5. The method of claim 4, wherein the pattern database further includes a pattern
2 definition that matches a command prompt message and further comprising dequeuing a
3 command from the command queue and submitting the command to the computing
4 arrangement in processing the response definition associated with the pattern definition that
5 matches a command prompt message.

Claim 6:

1 6. The method of claim 5, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, and the plurality of pattern definitions
4 includes a first definition matching a selected first message from the host, the first message
5 associated with a selected high-level operation of the data storage system, the pattern
6 definitions further including a plurality of definitions matching selected messages from the

- 7 data storage system generated in performing the high-level operation and having associated
8 responses that are commands required for the high-level operation,

Claim 7:

- 1 7. The method of claim 6, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, further comprising:
4 establishing a terminal emulation session between the operations processor and the
5 data storage system;
6 transmitting the command prompt messages from the data storage system to the
7 operations processor; and
8 submitting the commands to the data storage system via the terminal emulation
9 session.

Claim 8:

- 1 8. The method of claim 1, further comprising:
2 defining the command queue as a character string; and
3 adding character strings representing the commands to the command queue and
4 delimiting the character strings with a selected character.

Claim 9:

- 1 9. The method of claim 8, wherein the pattern database further includes a pattern
2 definition that matches a command prompt message and further comprising dequeuing a
3 command from the command queue and submitting the command to the computing
4 arrangement in processing the response definition associated with the pattern definition that
5 matches a command prompt message.

Claim 10:

- 1 10. The method of claim 9, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, and the plurality of pattern definitions
4 includes a first definition matching a selected first message from the host, the first message

5 associated with a selected high-level operation of the data storage system, the pattern
6 definitions further including a plurality of definitions matching selected messages from the
7 data storage system generated in performing the high-level operation and having associated
8 responses that are commands required for the high-level operation,

Claim 11:

1 11. The method of claim 8, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, further comprising:
4 defining a plurality of command queue data structures in the pattern database, each
5 command queue having a priority level relative to the other command queues and having
6 storage available for a plurality of commands;
7 for one or more pattern definitions that match the messages, selecting the command
8 queues as selected command queues and adding the one or more associated responses to
9 the selected command queues responsive to instructions associated with the pattern
10 definitions; and
11 for a pattern definition that matches a command prompt message from the data
12 storage system, dequeuing responses from the command queues in priority order and
13 submitting the commands to the data storage system.

Claim 12:

1 12. The method of claim 8, wherein the computing arrangement further includes a host
2 data processing system coupled to a data storage system, and an operations processor
3 coupled to the host and to the data storage system, further comprising:
4 establishing a terminal emulation session between the operations processor and the
5 data storage system;
6 transmitting the command prompt messages from the data storage system to the
7 operations processor; and
8 submitting the commands to the data storage system via the terminal emulation
9 session.

Claim 13:

1 13. An apparatus for automating operations of a computing arrangement coupled to a
2 message processor, comprising:
3 means for establishing a pattern database including a plurality of pattern definitions
4 and response definitions, each pattern definition being associated with one or more
5 associated response definitions, and one or more of the response definitions including one or
6 more commands and instructions for queuing a command to a command queue having
7 storage available for a plurality of commands;
8 means for receiving message character strings at the message processor;
9 means for searching the pattern database for pattern definitions that match the
10 message character strings; and
11 means for, responsive to the pattern definitions that match the messages, adding
12 associated commands to the command queue in processing the response definitions; and
13 means for dequeuing commands from the command queue and issuing the
14 commands to the computing arrangement.

Claim 14:

1 14. A computing arrangement having automation of complex manual operations,
2 comprising:
3 a host data processing system;
4 a data storage arrangement coupled to the data processing system;
5 a pattern-response database configured with a plurality of pattern definitions and
6 response definitions, each pattern definition being associated with one or more associated
7 response definitions, and one or more of the response definitions including one or more
8 commands and instructions for queuing a command to a command queue having storage
9 available for a plurality of commands;
10 a message processor coupled to the pattern-response database, the host system,
11 and to the data storage arrangement, the message processor configured to search the
12 pattern-response database for pattern definitions that match input message character
13 strings, add associated commands to the command queue in processing the response
14 definitions for pattern definitions that match the input message strings, and dequeue

- 15 commands from the command queue and issuing the commands to the data storage
16 arrangement.

Claim 15:

- 1 15. The system of claim 14, wherein the pattern-response database further includes a
2 pattern definition that matches a command prompt message, and the message processor is
3 further configured to dequeue a command from the command queue and submit the
4 command to the data storage arrangement in processing the response definition associated
5 with the pattern definition that matches a command prompt message.

Claim 16:

- 1 16. The method of claim 14, wherein one or more of the response definitions include
2 instructions for queuing commands to a selected one of a plurality of command queues, each
3 of the plurality of command queues having a priority level relative to the other command
4 queues and having storage available for a plurality of commands, and the message
5 processor is further configured to queue commands to selected ones of the command
6 queues specified in the response definitions, dequeue commands from the command queues
7 in priority order, and submit the commands to the data storage arrangement.